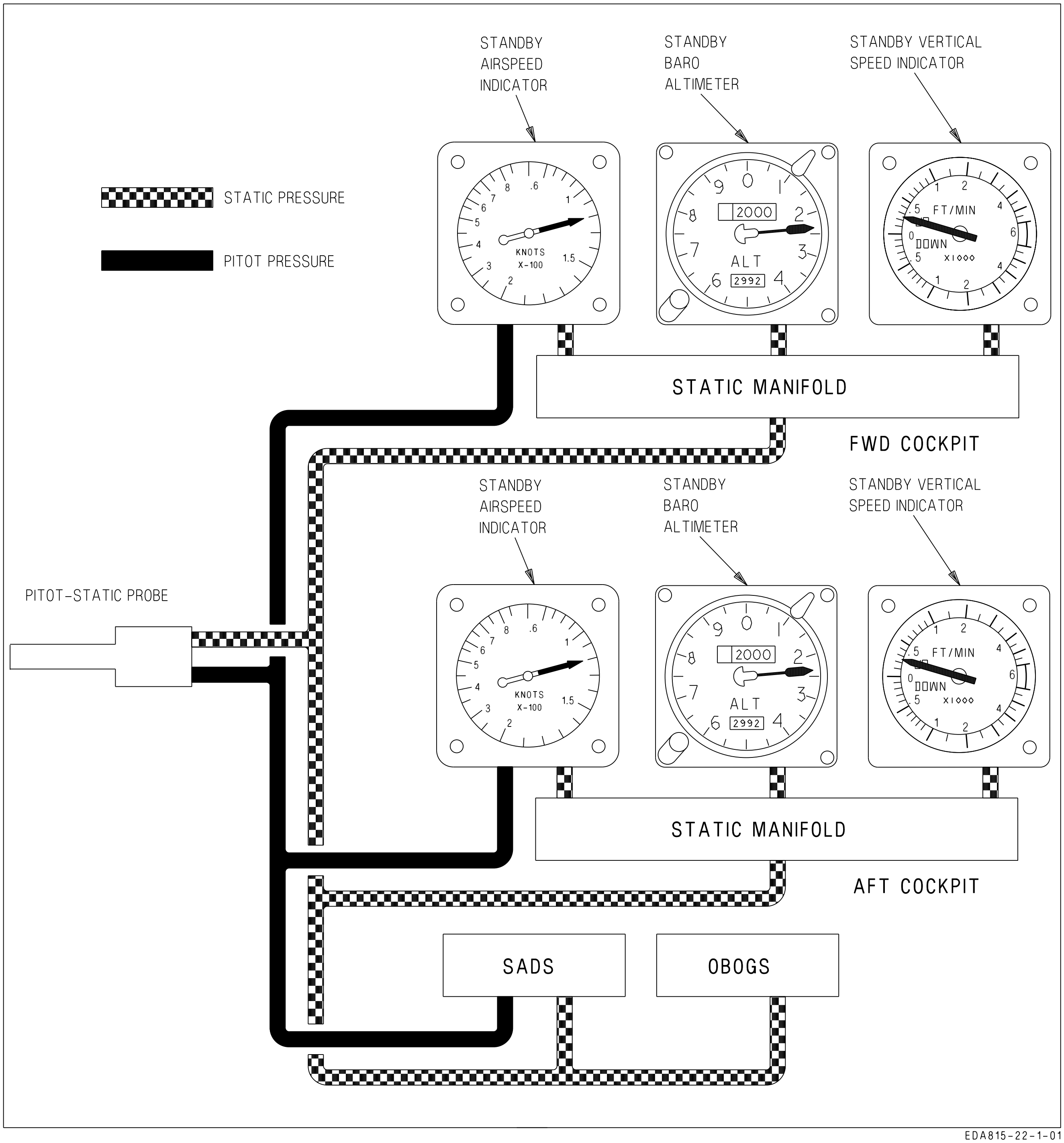

Figure 2-36. Pitot-Static System

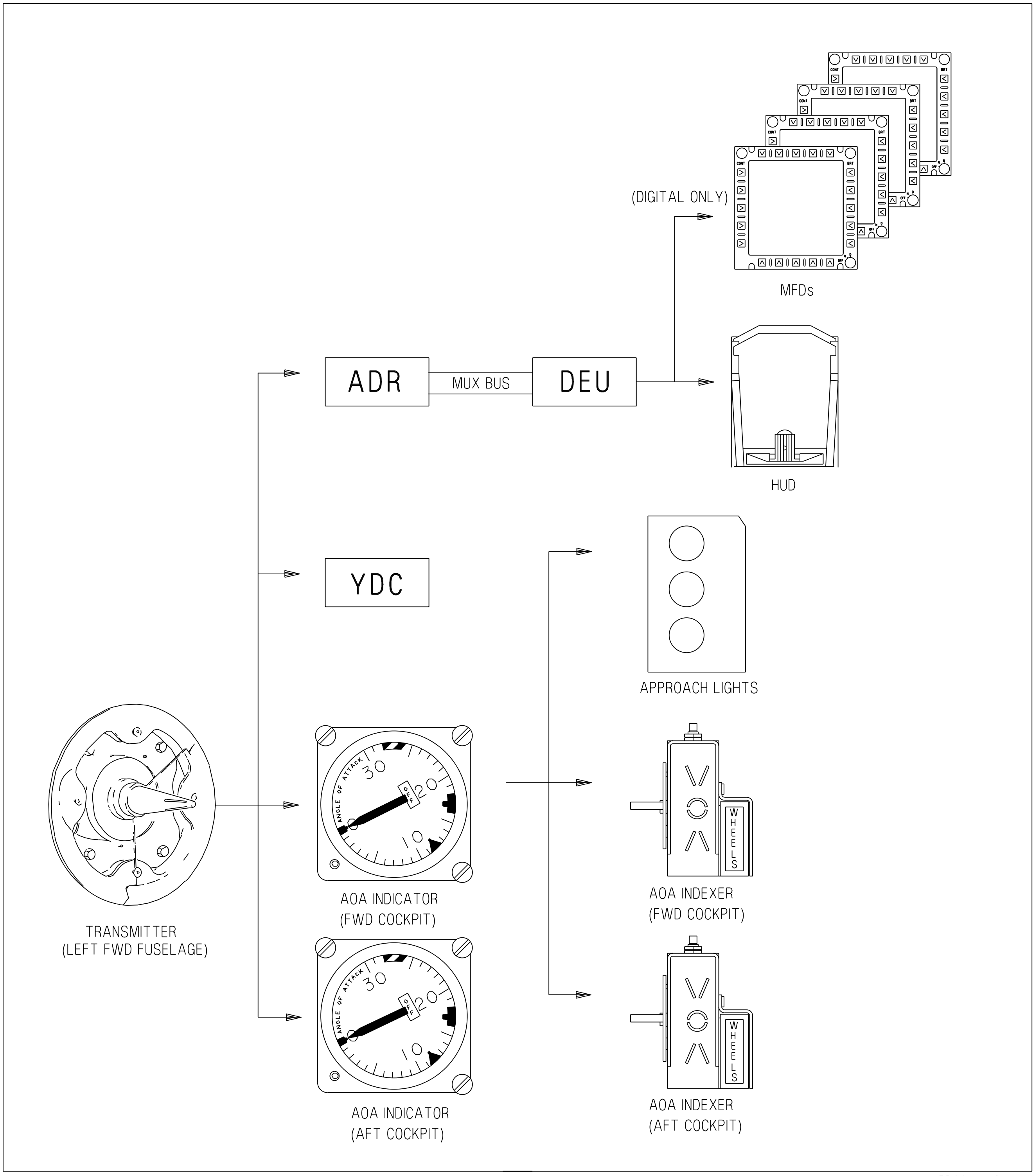

Figure 2-37. AOA System Diagram

pedal shakers and stall warning tone operate at 21.5 units AOA to provide artificial warning of stall AOA. See Figure 2-37.

2.21.1 AOA System Operation. The transmitter probe, extending outboard on the left side of the forward fuselage, senses the attitude of the aircraft in relation to the relative wind and transmits the angle of the probe to the ADR, AOA indicators, and the YDC. The ADR then transmits the AOA via the mux bus to the DEU for MFD and HUD display. AOA indexers and approach lights are routed through all three landing gear down proximity switches. When the landing gear is down and locked and the NLG weight-off-wheels, AOA discrete signals are provided from the forward indicator to illuminate the indexer and approach lights. For protection against icing and moisture control, the transmitter probe, and its case are electrically heated with weight-off-wheels. An upper and lower slot on the probe are plumbed to an internal chamber separated by a vane. The vane rotates with the probe to equalize the pressures in the internal chambers and orient the slots equally into the airstream. The resulting probe angle is transmitted to the HUD (via the ADR/DEU) and AOA indicators. The servo driven pointer on the indicator displays aircraft AOA in units and drives the AOA indexer lights as well as the external approach lights. The AOA probe and indicator are powered from the 28 VDC Essential Services Bus.

2.21.2 AOA Controls and Indicators.

2.21.2.1 AOA Indicator. The AOA indicator functions throughout the entire flight regime to display AOA information, see Figure 2-38. The indicator registers units of AOA to the relative airstream, from 0 to 30 units. An OFF flag is visible if electrical power is lost. The indicator is set with the optimum unit setting at the 3 o'clock position. Both cockpit AOA indicators independently receive their input from the AOA probe.

2.21.2.2 AOA Indexer. The AOA indexer, located on the glareshield in both cockpits, consists of three indexer lights; the upper chevron (∨) is green and indicates a high (≥18 units) AOA, the center donut (O) is amber and indicates the optimum (17 units) AOA, and the lower chevron (∧) is red and indicates a low (≤16 units) AOA. Two intermediate conditions are also indicated by illuminations of the donut (O) with the upper or lower chevron. Dimming control of the indexer lights is achieved by a four position lever mounted next to the lights. Moving the lever up brightens the lights. The indexer includes press-to-test light capability. Both cockpit indexers receive their input from the forward cockpit AOA indicator. The indexers provide the principal reference for controlling airspeed during landing approaches.

NOTE

The lack of AOA indexers and approach lights with the LDG GEAR handle down may indicate one or more landing gear not down and locked.

2.21.2.3 Approach Lights. The external approach lights assembly is located on the nose gear strut. The assembly provides the LSO with an indication of AOA and consists of three separate lights covered by red, amber, and green lenses. The corresponding AOA conditions are shown to the LSO as green for too high an AOA, amber for optimum AOA, and red for too low an AOA. The lights are controlled by the AOA system and function when the landing gear is down and locked in flight and extinguish upon landing. The lights are controlled by the HOOK BYP (bypass) switch in the forward cockpit. Placing the switch to CARRIER position causes the lights to flash if the arresting hook is not down. With the switch in FIELD, the lights remain steady regardless of arresting hook position. Day or night operation is selected by the PANEL light switch in the forward cockpit. Placing the switch to the OFF position selects day (bright) illumination. With the switch at PANEL, night (dim) illumination is selected.

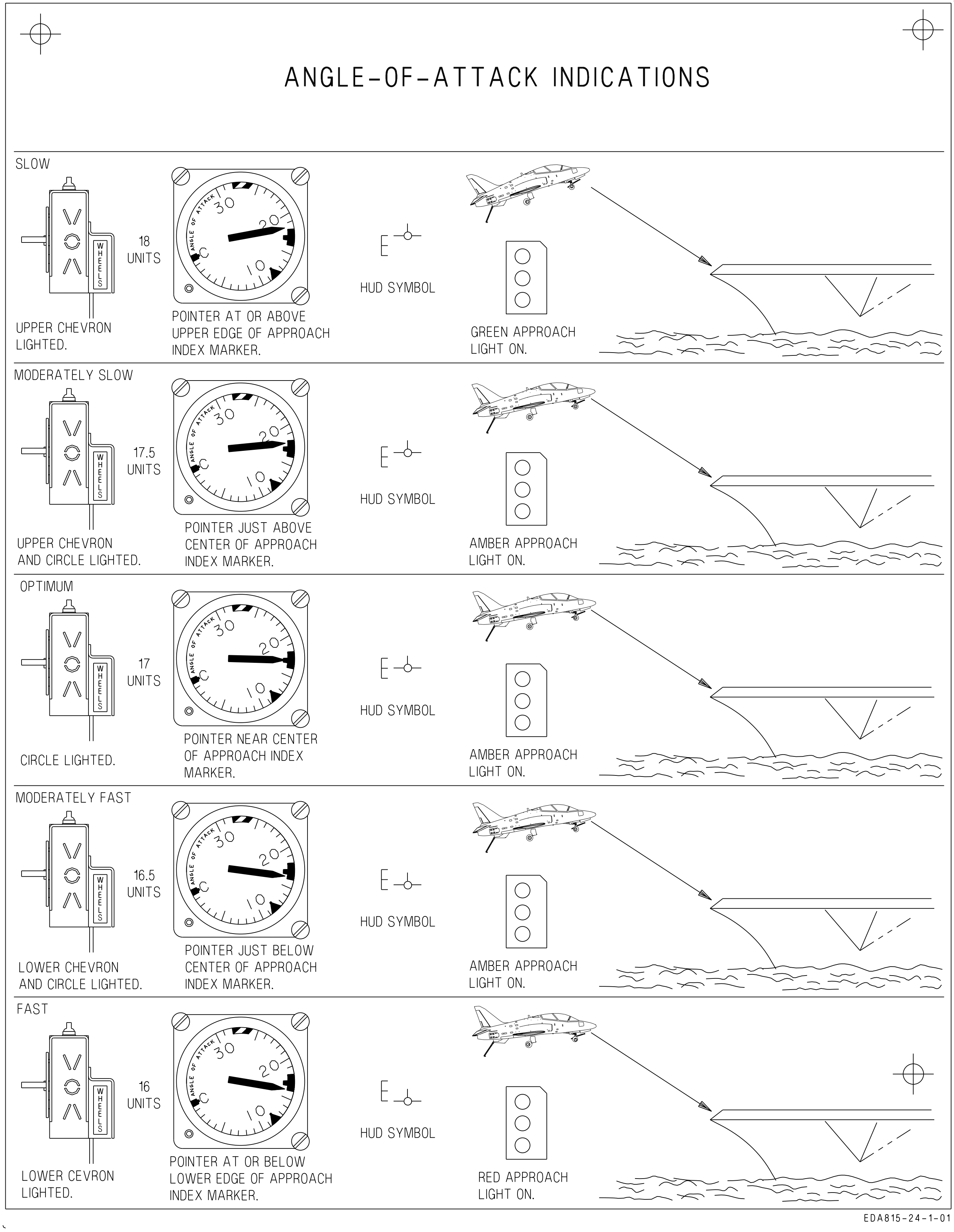

Figure 2-38. AOA System Indications

2.21.2.4 HOOK BYP Switch. The two position toggle HOOK BYP switch is located in the front cockpit, on the right side of the main instrument panel. The switch has the following positions:

CARRIER	Approach light/AOA indexers flash if the landing gear is down and locked and the arresting hook is not down.
FIELD	Approach lights/AOA indexers operate steady regardless of the arresting hook position.

2.22 RADAR ALTIMETER

The radar altimeter (RALT) system consists of a receiver-transmitter, and two antennas. Refer to the BIT System description, paragraph 2.26 and subsequent, for a description of the RALT BIT. The RALT employs the pulse radar technique to provide instantaneous AGL information from 0 to 5,000, feet in 10 foot increments, at aircraft attitudes of 40 degree or less angle of bank or pitch. Aircraft height above ground is determined by measuring the elapsed transit time of a radar pulse, which is converted to feet. Audio and visual warnings are activated when the aircraft is at or below the selected low altitude limit (LAW setting). The system provides the radar altitude to the ADR which in turn forwards the altitude to the DEU for display on the MFDs and HUD. The DEU commands the HUD to display radar altitude below the altitude box and MFDs (ADI display) to display the radar altitude below the barometric altitude scale. The letter R will be displayed to the right of the altitude to indicate radar altitude. If the ADR or RALT signal is invalid, fails, or exceeds 5,000 feet the radar altitude will be removed and the letter R will remain displayed on the HUD and ADI display. After IBIT is performed on the ground, a RALT failure is reported by the message DEGD on the BIT display. On the ground (weight-on-wheels) the radar altitude defaults to 10 feet.

RALT power is controlled by the RALT PWR option on the BIT display. Successive actuation of the RALT PWR option turns on/turns off (boxes/unboxes) the RALT. Upon power up of the electrical system with weight-on-wheels, the RALT will default to the power on (boxed) state. If a power interruption occurs with weight-on-wheels the RALT will again default to the power on state regardless of the power state prior to the interruption. When airborne and a power interruption occurs, the RALT will return to the power state prior to the interruption.

2.22.1 Low Altitude Warning. The LAW consists of a LAW advisory displayed in the MFD advisory window, an audio warning tone, and flashing of the LAW setting and option accompanied by the HUD warning indication. The LAW is initiated when the aircraft descends to or below the LAW setting and continues until the aircraft ascends above the LAW setting, see Figure 2-39.

With the landing gear extended the LAW advisory/tone and HUD warning will be displayed/emitted for 3 seconds. With the landing gear retracted, the LAW advisory/tone and HUD warning will be displayed/emitted continuously until rejected. The LAW setting and option will continue to flash after the advisory and tone are rejected as a reminder until either the LAW setting is reset to below the aircraft's altitude, the aircraft climbs above the LAW setting, or the aircraft transitions to weight-on-wheels. Flashing of the LAW setting and option are not affected by the landing gear position.

2.22.2 LAW Setting. The LAW setting is displayed on the ADI display above the LAW option. The setting may be set using either the ADI display or the DEP. Upon power up the LAW setting defaults to 500 feet.

2.22.2.1 ADI Entry. The LAW setting is controlled from the ADI display by selecting the LAW option and LAW increment/decrement options. Successive actuations of the LAW option selects/deselects (boxes/unboxes) the option. Selection of the BNGO or PT options will unbox the option. When the LAW option is selected, the LAW increment and decrement options are displayed. Selecting either option changes the LAW setting accordingly in 10 foot increments. Pressing and holding the increment/ decrement option initially changes the LAW

4. Harness - AS REQUIRED

5. Speed brakes - AS REQUIRED

6. Anti-skid - AS REQUIRED

7.13.2 Approach. Enter the pattern as prescribed by local course rules. At the break, reduce thrust as required and extend the speed brakes. As the airspeed decreases through 200 KIAS, lower the landing gear and flaps/slats. Decelerate to on-speed, and perform an angle of attack check (airspeed at 17 units AOA).

GROSS WT. (Pounds)	FULL FLAPS (KIAS)	HALF FLAPS (KIAS)	ZERO FLAPS (KIAS)	EMERG FLAPS (KIAS)
11,000	114	132	151	114
12,000	119	138	157	119
13,000	124	143	164	124
14,000	128	149	170	128
15,000	133	154	176	133

Complete the landing checklist prior to reaching the abeam position. Continue past the abeam to the 180 degree position, then commence the approach turn using approximately 27 to 30 degrees angle of bank. Control the rate of descent to reach 450 feet AGL at approximately the 90 degree position. At the 45 degree position, altitude should be 350 to 375 feet AGL, intercept the glideslope and fly optimum AOA to touchdown. Slow engine response may preclude recovery from high rates of descent in close, which may occur during rates of descent in excess of 600 feet per minute at touchdown.

7.13.3 Normal Field Landing. At touchdown retard the throttle to IDLE. Maintain back pressure on throttle until ground idle is achieved.

CAUTION

Failure to retard the throttle from approach idle to idle after landing could result in hot brakes during subsequent ground operations.

NOTE

When the ANTI-SKID switch is set to ON, the approach idle stop retracts immediately with weight-on-wheels. When the ANTI-SKID switch is set to OFF the approach idle stop will not retract until 2 seconds after weight-on- wheels.

Braking or a combination of braking and NWS inputs may result in PIO. If PIO about the runway centerline occurs, discontinue braking and use low gain NWS to accomplish a straight track down the runway. Once a straight track is accomplished, resume normal braking. Slight pumping of the brakes prior to normal brake application may preclude additional PIO. See Figure 7-4 for a typical field landing.

CAUTION

Improper braking and NWS technique may result in exaggerated PIO.

7.13.4 Crosswind Landing.

7.13.4.1 General. The aircraft is easily controllable in cross wind landings. Full flaps are recommended for crosswind landings. The approach and rollout characteristics with half flaps and slats are similar except for the airspeeds. Landings without flaps and slats will exhibit decreased lateral and directional stability in the approach since the ARI and bank angle feedback are turned off with flaps and slats up at less than 217 KIAS. The optimum approach technique is the wings level crab. A wing down

7.13.6 Flaps/Slats Up Landing. Fly optimum AOA approach (approximately 42 to 49 KIAS above full flaps/slats airspeed).

CAUTION

Ensure maximum wheel speed is not exceeded at touchdown.

NOTE

With flaps up and gear down, minimize sideslip excursions. Sideslip angles of 8 degrees or greater may cause structural damage to the nose landing gear doors.

7.14 WAVEOFF/MISSED APPROACH

To execute a waveoff, immediately add full power, retract speed brakes, maintain landing attitude (not to exceed optimum AOA) and establish a safe rate of climb. If desired, with a positive rate of climb, raise the landing gear and flaps/slats above 140 KIAS. Transition from full flaps to 1/2 flaps may be accomplished above 125 KIAS.

7.15 AFTER LANDING (CLEAR OF RUNWAY)

1. Ejection seat SAFE/ARMED handle - SAFE
2. Speed brakes - RETRACT
3. Flaps/slats - UP
4. Trim - SET TO ZERO
5. NAV equipment/IFF - OFF
6. HUD - OFF
7. PITOT HEAT switch - OFF
8. Strobe light - OFF
9. VCR switch - OFF
   Allow 10 seconds before engine shutdown to ensure tape unthreads.

7.16 BEFORE ENGINE SHUTDOWN

The GINA should not be turned off before electrical power is removed. The DEU retains the last position information it receives from the GINA upon electrical shutdown as waypoint 0.

1. Parking brake - SET
2. BIT status - RECORD
3. Perform IBIT on DEGD equipment
4. IBIT results - RECORD
5. MANT display - CHECK
6. Aircraft exceedance - CHECK

NOTE

Report all A/C exceedance and/or ADR memory overflow indications to maintenance.

7. GINA power - OFF (in chocks)
8. MFDs - OFF
9. UHF/VHF radios - OFF
10. VCR switch - OFF
11. OBOGS FLOW selector - OFF
12. OBOGS/ANTI-G switch - OFF
13. Idle RPM - ENSURE WITHIN ±2% OF IDLE RPM PER FIGURE 4-2.

7. Canopy - CLOSED, LOCKED, LIGHT OUT

8. Harness - CONNECTED

9. Ejection seat - ARMED

10. Ejection seat handle - CLEAR OF CONTROL STICK

11. Parking brake - DESELECT

8.7 TAXI

Taxiing aboard ship is much the same as ashore, but increased awareness of jet exhaust and aircraft directors is mandatory. Nose wheel steering is used for directional control aboard ship. Higher than normal power settings may be needed while taxiing on the flight deck due to ship motion, wind over the deck, jet blast, or any combination of these effects.

Taxi speed should be kept under control at all times. The canopy shall be down and locked, oxygen mask on, and the ejection seat armed during taxi.

Increasing power slightly prior to hot gas ingestion increases air flow for engine cooling. Monitor EGT; if temperature exceeds limits, engine shut down should be considered.

CAUTION

> Whenever hot jet exhausts from other aircraft are directed toward the intake, a potential for overtemp exists.

8.8 BEFORE CATAPULT HOOK-UP

Before taxi onto the catapult, complete the takeoff checklist and ensure the heading is aligned with the base recovery course (BRC). With flaps set to FULL, set takeoff trim to 3.5 degrees noseup. For normal operation, 15 KIAS endspeed above the minimum endspeed is recommended. See Figure 8-1.

CAUTION

> Takeoff trim setting is only valid with hands off the control stick. Care should be taken to ensure that proper trim setting is set prior to launch.

NOTE

> System alignment in the directional gyro (DGRO) mode requires correct heading information to be manually entered prior to launch.

1. CONTR AUG switch - ALL

2. ANTI-SKID switch - OFF

3. Flaps/Slats - FULL

4. Trim:

    a. Rudder and aileron - ZERO

    b. Stabilator - 3.5 DEGREES NOSE-UP

5. Canopy - CLOSED, LOCKED and LIGHT OUT

6. Harness - CONNECTED

7. Ejection Seat - ARMED

Correct stabilator trim is critical to obtaining adequate catapult fly-away performance. Stabilator trim affects initial pitch rate and fly-away AOA. A low stabilator trim setting lowers the initial pitch rate and fly-away AOA, resulting in a flatter fly-away attitude and possible sink off bow.

8.9 CATAPULT HOOK-UP

Before taxiing past the shuttle, verify the aircraft gross weight and complete the takeoff checklist. Approach the catapult track slowly while lightly riding the brakes. Use minimum power required

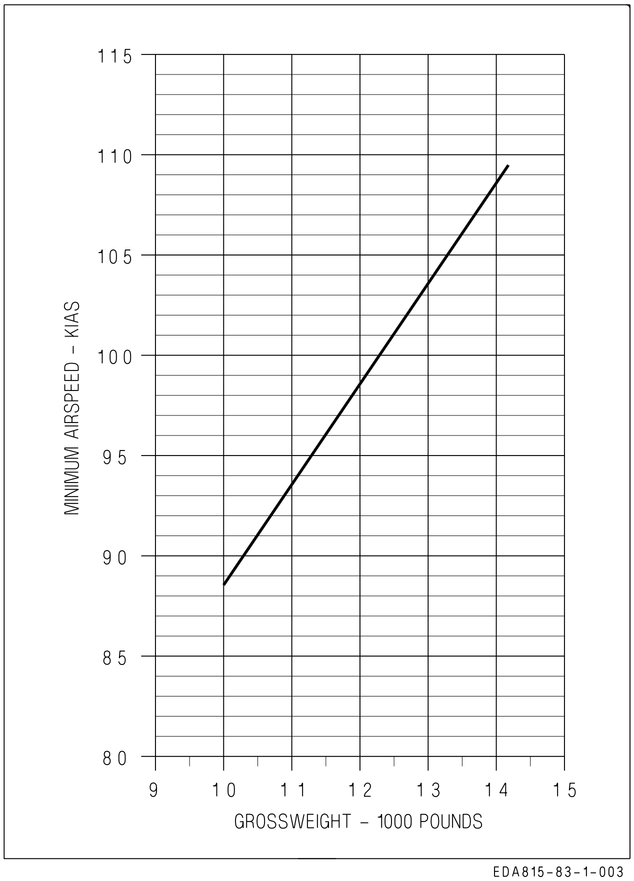

Figure 8-1. Catapult Launch Minimum Endspeed

ready, place your head against the headrest and render an exaggerated hand salute with your right hand to the Catapult Officer. There will be a 2 to 4 second delay before catapult firing due to sequence followed by the catapult crew.

Catapult launches should be planned for a 15 KIAS excess end airspeed. Excess end airspeed is an additional safety factor added to the minimum airspeed required to effect a safe, but not optimum, catapult launch, see Figure 8-1. The minimum airspeed was determined during shipboard carrier suitability trials and is applicable for specific gross weights and ambient temperature conditions.

NOTE

- Figure 8-1 denotes the minimum catapult launch airspeed at 59 °F U.S. Standard Day. Most catapult launches are programmed to give 10 to 15 KIAS above the airspeeds depicted on the figure. Trim should be set at 3.5 degrees nose up.
- 15 KIAS above this airspeed results in no settling of the aircraft after launch.
- To correct for ambient temperature, increase the minimum airspeed by the following amount:

70 °F	2 KIAS
80 °F	3 KIAS
90 °F	4 KIAS

- Refer to A1-T45AB-NFM-300, Figures 26-11 through 26-13, for aircraft stall speeds.
- The speeds depicted in Figure 8-1 are applicable to any catapult.

Grip the control stick lightly and allow it to move aft during the launch as it is affected by the catapult acceleration. It should be noted that the control stick moves laterally to the left if not restrained during the launch, resulting in a slight left wing down condition after launch which can be easily controlled with lateral stick following launch.

After leaving the catapult, the elevator trim setting causes the aircraft to rotate to the pitch attitude of 8 to 10 degrees. The resulting climbing attitude is the optimum for aircraft weight and, once attained, should be maintained with stick positioning and trim. The AOA indicator should indicate approximately 19 units. After launch, maintain optimum AOA and pitch angle, and monitor the airspeed and altimeter for increasing values. Instrument scan after launch should include all flight instruments. Initial pitch attitude and wing position is immediately indicated on the ADI. Airspeed information is available and can be monitored during the catapult stroke. Vertical speed lags slightly but may be used after leaving the catapult. The altimeter, like the VSI, lags and accurate information is not available for use immediately after launch. It must be emphasized that the most important requirement after catapult launch is the necessity to climb.

8.13 CARRIER LANDING

Enter the carrier landing pattern (Figure 8-2) with the hook down. Make a level break from a course parallel to the BRC, close aboard the starboard side of the ship. Below 200 KIAS lower the gear and flaps/slats. Descend to 600 feet when established downwind. Complete the landing checklist and cross-check AOA and airspeed prior to the 180 degree position.

With a 25 knot wind over the deck begin the 180 degree turn to the final approach when approximately abeam the LSO platform. When the meatball is expected to be acquired, transmit call sign, Goshawk, Ball or Clara and fuel state (nearest 100 pounds). Fly the aircraft at optimum angle of attack from the 180 degree position to touchdown.

8.14 ARRESTMENT AND EXIT FROM THE LANDING AREA

Upon touchdown, add power to MRT and retract the speed brakes. When forward motion has stopped, reduce power to IDLE and allow the aircraft to roll back a short distance. Hold the brakes and raise the hook on signal from the taxi director. Use high gain NWS and approximately 70 percent power to expedite exit from the landing area.

NOTE

Utilize a combination of power and brakes to stop the rearward motion caused by the roll back. Extreme use of the brakes to halt this motion may cause the aircraft to tip back excessively.

8.15 WAVEOFF TECHNIQUE

To execute a waveoff, immediately add power to MRT, retract the speed brakes, and smoothly adjust the nose of the aircraft to maintain landing attitude (not to exceed 17 units AOA) and establish a safe rate of climb. Waveoff should be up the angled deck.

WARNING

Over rotation on a waveoff can place the aircraft on the back side of the power required curve, where sufficient power is not available to stop the descent.

CAUTION

Exceeding optimum angle of attack on a waveoff lowers the hook to ramp clearance and can result in an in-flight engagement. The resulting arrestment can cause damage to the aircraft.

After a waveoff or a bolter, establish a positive rate of climb. At the bow, turn to parallel the BRC. Do not cross the bow while flying upwind.

8.16 POST LANDING PROCEDURES

The canopy should remain closed until after engine shutdown. Do not release brakes until the aircraft has at least an initial three-point tiedown. If the aircraft is towed or pushed, be alert for hand signals from aircraft handling personnel. Set parking brake and execute a normal shutdown when the cut signal is received.

If the aircraft is to be spotted on the hangar deck, safe the seat, unstrap, remove helmet and open the canopy after the aircraft is chocked and chained on the elevator. Hold the brakes after being spotted in the hangar bay until the required number of tiedowns have been attached.

8.16.1 Hot Refueling

1. Pilot signal for cutoff at 2,800 pounds.

8.17 CARRIER CONTROLLED APPROACH (CCA)

8.17.1 General. The pattern procedures and terms used for carrier controlled approaches shall be in accordance with the CV NATOPS manual.

8.17.2 Procedures. Lower the hook entering the holding pattern and maintain maximum

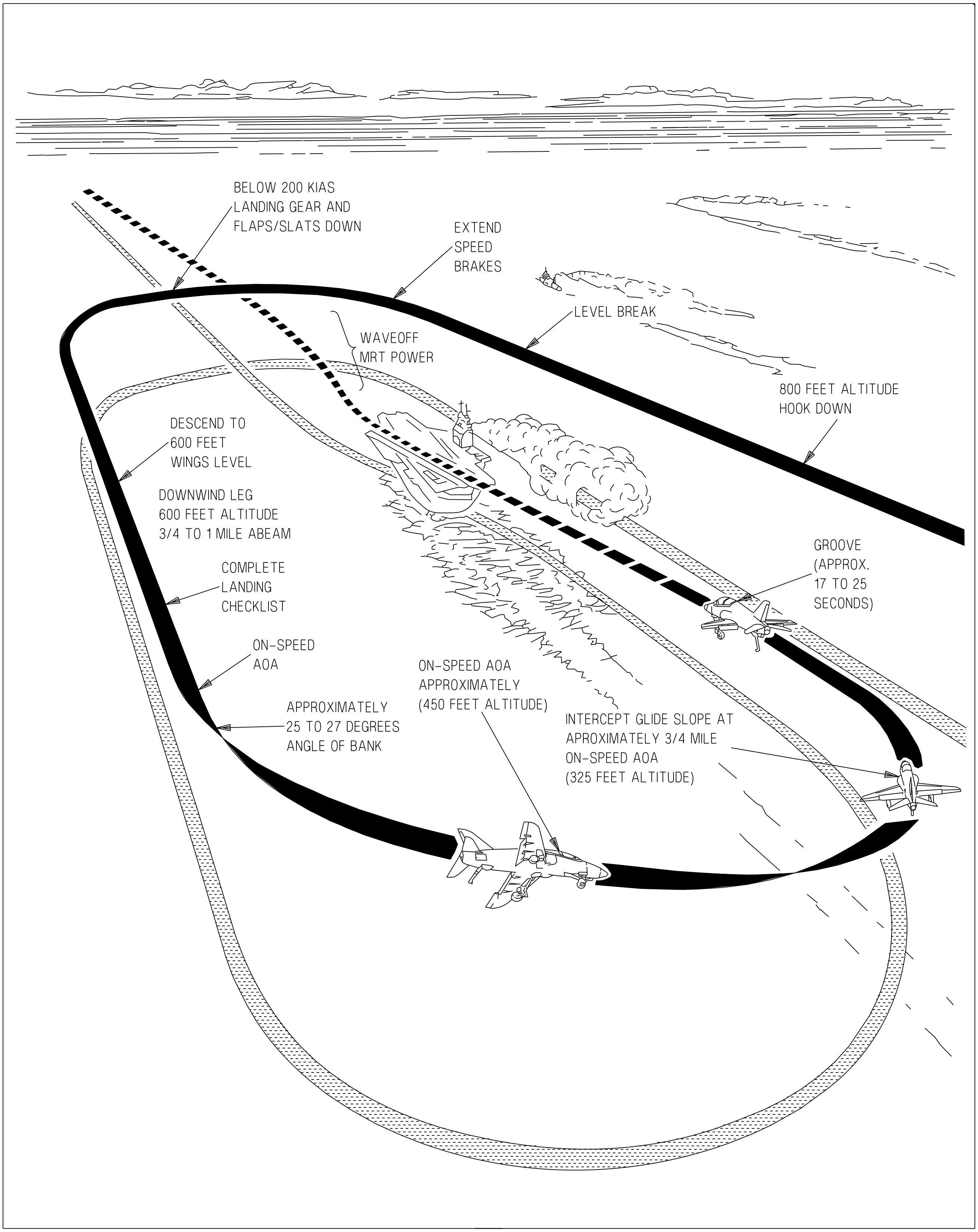

Figure 8-2. Carrier Landing Pattern (Typical)

CHAPTER 11

Flight Characteristics

11.1 INTRODUCTION

The flight characteristics of the aircraft described in this section are based on flight test information unless otherwise noted.

11.2 FLIGHT CONTROLS

The flight control forces are generally light to moderate. The aircraft is quite responsive throughout most of the flight envelope.

11.2.1 Ailerons.

11.2.1.1 Cruise Configuration. Roll control is good throughout most of the flight envelope and aileron forces are independent of airspeed. The aircraft responds quickly to roll initiation. Typically maximum roll rates are 160 to 170 degrees/second and are obtained from 350 to 400 KIAS below 0.85 Mach, however, roll rates up to 270 degrees/second can be experienced with large lateral inputs at 0.82 to 0.84 Mach.

11.2.1.2 Landing Configuration. Roll response is crisp and predictable below 21 units AOA. With the CONTR AUG in ALL, there is very little adverse yaw, even with large aileron inputs. Above 21 units AOA, the roll rate decreases and adverse yaw increases as AOA increases.

11.2.2 Stabilator. Pitch control is generally very crisp and responsive. The stick force required for any maneuver depends on the control stick displacement from the trimmed position and to some extent, upon the quickness of the input. Throughout the heart of the envelope from 0.5 to 0.85 Mach, maneuvering stick forces are relatively moderate and the aircraft response is predictable. In the transonic region from 0.86 to 0.99 Mach, the stick forces are light and g's should be applied more judiciously and at a slower rate to avoid overstress. When large stabilator deflections are required, as at low airspeed or above 1.0 Mach, the stick forces are heavy.

11.2.3 Rudder. The rudder system is reversible, except that it contains a no-float rudder lock. Aerodynamic forces are fed back through the rudder pedals whenever the rudder is outside the breakout band for the no-float rudder lock. The rudder pedal forces are light at low airspeeds and become progressively heavier as airspeed increases. The rudder is not very effective in rolling the aircraft at any speed. Above 400 KIAS, very little yaw can be generated with the rudder due to aerodynamic hinge moments holding rudder deflection to a minimum. Below 0.85 Mach, the aircraft rolls slightly in the direction of the applied rudder, while above 0.85 Mach the roll is away from the applied rudder.

11.2.4 Control Augmentation Off or Failed. With control augmentation paddled off or failed, rudder trim, SBI, dutch roll damping and turn coordination (ARI) functions are lost. If the problem is in the dutch roll damping or ARI functions, the rudder trim and SBI functions may be restored by momentarily selecting RESET, then remaining in the SBI position. With no dutch roll damping or ARI, the aircraft is a less stable in roll and yaw in the landing configuration, but easily controllable. Adverse yaw will be noticeable with large aileron inputs and small dutch roll oscillations may be evident.

11.2.4.1 Control Augmentation In SBI. With control augmentation in SBI, dutch roll damping and ARI functions are lost. The speed brake interconnect remains active to damp g excursions with speed brake extension and retraction. In the landing configuration, aircraft handling characteristics are similar to those with control augmentation off or failed except that rudder trim remains active.

NOTE

C AUG should not be intentionally set to SBI except during the permitted intentional departures and when necessitated by a failure or an emergency situation. The SBI setting results in undesirable low speed flying qualities and exacerbates wing roll-off and sideslip during stalls.

11.2.5 Speed Brakes. The speed brakes are operable throughout the flight envelope; however, full extension of the speed brakes occurs only at 340 KIAS or less. If full extension exists, it is available up to 380 KIAS, where blowback begins. Extension above 340 KIAS results in partial deflection, but full deflection becomes available once the airspeed has decreased to 340 KIAS.

11.2.6 Trim. Longitudinal, lateral, and directional trim is capable of reducing control forces in all axes to zero for all stabilized level flight conditions. As airspeed increases to approximately 300 KIAS, nosedown trimming is required to maintain level flight. From 300 to 450 KIAS, trim changes are minimal. When accelerating above 0.85 Mach, slight noseup trim is required. During deceleration the required trim changes are reversed, becoming more pronounced in the low airspeed range. Above 0.9 Mach, establishing a trimmed constant Mach dive is difficult and trimming is not recommended, as control forces become more sensitive.

11.2.6.1 Trim Changes Due To Speed Brakes. The trim change due to speed brake extension/retraction is noticeable, especially in formation flight. However, it is more pronounced with SBI inoperative. At Mach numbers below 0.8, the aircraft trim change with speed brake extension is slightly noseup and requires a small push force to counteract. At Mach numbers above 0.8, the aircraft trim change is nosedown and requires a slight pull force. The opposite occurs upon retraction. The trim change due to speed brake extension in the landing/approach configuration is negligible. With C AUG failed/SBI inoperative, the trim changes are in the same direction as above, but the magnitude is higher (as much as 1 to 2g's), especially from 220 to 300 KIAS. Parade formation speed brake extension/retraction should be avoided in this region with SBI inoperative.

NOTE

During speed brake extension/retraction, expect aircraft pitch attitude change of up to ±2 degrees, respectively.

11.2.6.2 Trim Changes Due To Wing Flaps /Slats And Landing Gear. Extension of the flaps/slats requires a moderate push force (3 to 4 pounds) to prevent an increase in altitude, often described as a balloon response. As the flaps/slats reach full down, up to one third aft stick is required to prevent a large settle in altitude. Stick forces are greatest at 200 KIAS and are reduced at lower airspeeds. Stick forces during flap/slat retraction are opposite in direction and equal in magnitude. Extension/retraction of the landing gear requires a lower magnitude trim change in the direction opposite the flap/slat trim change. Small, uncommanded yaw excursions may be experienced during landing gear transition.

11.2.7 Emergency Gear. Extending gear by the emergency method produces a reduction in directional stability due to the main landing gear doors remaining fully open and the nose landing gear forward doors being actuated up to within 10 degrees of fully closed by an electrical actuator. In this configuration, the aircraft is less stable directionally and the pilot needs to use coordinated stick and rudder during approach to landing to control the slight yaw excursions which may be encountered.

11.2.8 Emergency Flaps. Emergency flap extension, or a failure of the slats to extend during normal operation, produces a slight increase in aft stick force (2-3 lbs.) and the nose of the aircraft noticeably pitches down (approx. 9°). Coincident with the previously described trim changes, altitude can be expected to "balloon" up to 200 feet. An inordinately large forward stick displacement is required to completely counter this "ballooning" effect and is therefore not recommended. Following complete flap extension, the trimmed nose position for straight and level flight is noticeably low at 3-5° nose down. Recommended on-speed AOA for approach to landing in this configuration is 17 units, and approach speed is the same as for the PA configuration.

11.3 GENERAL FLIGHT CHARACTERISTICS

11.3.1 Level Flight. At full power, the maximum airspeed obtainable in level flight is approximately 0.83 Mach. The aircraft is essentially buffet-free in level flight, but there is a slight nosedown pitch change above about 0.8 Mach. At low altitudes (below 5,000 feet MSL) and airspeeds above 450 KIAS, longitudinal control becomes sensitive.

the clean aircraft. In the landing configuration, up to 3 degrees of additional aileron trim is required.

11.6 HIGH ANGLE OF ATTACK CHARACTERISTICS

WARNING

Maneuvering within 20 degrees of vertical pitch attitude at airspeeds less than 100 KIAS could result in departure and inverted spin entry.

CAUTION

- Abrupt stick inputs to or near full back stick with the throttle above idle may result in engine surge, overtemperature and/or damage due to rapid changes in AOA and/or sideslip.
- Avoid abrupt forward stick inputs due to the possibility of encountering a forward stick departure.
- Risk of engine stall increases when maneuvering at high angles of attack and/or above heavy buffet, when the engine is accelerating from low power settings or at high power settings.

NOTE

- Rapid engine acceleration from low power settings can increase engine stall sensitivity and decrease engine stall margin.
- Engine stall characteristics vary depending on power setting, engine acceleration, and maneuver severity. Self-recovering pop stalls are sometimes indicated by an audible bang or pop with correct engine operation being immediately restored with no pilot action. Locked-in stalls at low power settings are characterized by a slow EGT rise (approximately 12° C per second) and a gradual decay in RPM, with no audible cue to the pilot. EGT rise during a low power stall accelerates rapidly if the throttle is advanced. Locked-in stalls at high power settings are sometimes indicated by an audible bang or pop and are characterized by a very rapid temperature rise. A locked-in stall can sometimes be cleared by positioning the throttle to idle. If the stall remains locked-in, the engine must be shut down to clear it.

11.6.1 Stall Characteristics. In all configurations, stalls are defined initially by wing roll off and an associated pitch break. The amount of wing roll off is highly variable, particularly in configurations with the slats retracted. The aircraft provides very little natural stall warning, leaving rudder shakers and AOA warning tone the best indication of impending stall.

11.6.1.1 Cruise Configuration. In the cruise configuration, there is little or no aerodynamic stall warning such as buffet or wing rock until immediately prior (1 to 2 knots) to stall. In power on (thrust for level flight) stalls, the high pitch attitude (approximately 20 degrees) is a good secondary indication of impending stall. With idle power, the pitch attitude is significantly less and might not be noticeable. Rudder pedal shaker and tone come on at 21.5 units, which is about 4.5 units (10 knots) prior to stall in this configuration. Just prior (1 unit AOA or less) to stall, a slight wing rock and buffet occurs. If the aft stick is eased at this point the aircraft recovers prior to stall. If the aft stick force is increased, an uncommanded wing drop of 25 to 30 degrees occurs, accompanied by a mild pitch break which defines the stall at about 26 units AOA. Due to the longitudinal stick gearing at near full aft stick travel, a small amount of aft stick commands a large stabilator deflection, so the rate of stall onset occurs more rapidly.

11.6.1.2 Power Approach (PA)/Takeoff (TO) Configuration. With gear down and flaps/slats HALF or FULL, there is no noticeable increase in buffet during the approach to stall until immediately prior to the stall. In power on stalls, the high pitch attitude (about 20 degrees) is a good secondary indication of impending stall. With power off the pitch attitude is significantly less and may not be noticeable. With gear down and flaps/slats full (PA), the first indication of impending stall is a slight longitudinal instability and wing rock at about 28 units AOA. This is followed, at about 29 to 30 units AOA, by a noticeable increase in buffet and closely precedes an uncommanded wing drop of about 15 to 20 degrees and pitch break which define stall. Stall warning rudder pedal shaker comes on at 21.5 units, which is about 8.5 units (10 knots) prior to stall in PA configuration. The indicated airspeed from 28 units AOA to stall may decrease only one knot. Release of aft stick pressure at this point produces an immediate reduction in AOA and stall recovery. If aft stick is maintained, the nose pitches down about 6 degrees. With gear down/flaps half/slats down (TO), the stall occurs about 5 to 6 knots faster than in PA configuration, about 29 to 30 units AOA and stall characteristics are very similar. Speed brake position has no effect on stall characteristics. In all configurations, stall recovery is immediate upon release of aft stick. Altitude loss can be minimized by application of MRT power and capturing 24 units AOA.

11.6.1.3 Emergency Flap Configuration. Stall characteristics with emergency flaps extended are significantly different than in PA configuration or normal CR configuration. The aircraft exhibits no natural stall warning during the approach to stall. Slight changes in stall entry technique may affect actual amount of roll off seen at stall.

With flaps deployed by the emergency method, gear down and yaw damper in ALL, the stall warning rudder pedal shaker comes on at 21.5 units AOA, closely followed by the stall at 23-25 units AOA. (Stall airspeed is 7-9 KIAS greater than PA configuration at the same gross weight.) The stall is very disorientating and is characterized by a slight pitch-up of 4-5° followed by an abrupt roll off of 60-80° AOB. Following roll off, the aircraft is left in a 30° nose down pitch attitude. If recovery is initiated immediately upon roll off, altitude loss can be minimized to 700-1000 feet.

With flaps deployed by the emergency method, gear up and yaw damper in ALL, stall occurs at 23-25 units AOA, closely following activation of rudder pedal shaker at 21.5 units. This stall is characterized by a slight pitch-up of about 3°, followed by an abrupt roll off of nominally 110-120°. Airspeeds during stall recovery (using a 2 g recovery) may reach 190 KIAS with altitude loss of approximately 2500 feet. Holding full aft stick at stall may result in roll oscillations, continued rapid roll off of as much as 360° and final pitch attitude approximately 80° nose down.

C AUG setting in SBI significantly increases the wing roll off and sideslip during the stall. With the gear extended, sideslip limitations may be exceeded during the stall.

11.6.1.4 External Stores. With wing stores or baggage pod loaded, stall characteristics are very similar to the clean aircraft, however, stall occurs at about 1 unit lower AOA. With wing store asymmetry, the aircraft rolls into the heavy wing and may require up to one-third lateral stick to maintain wings level on approach to stall. However, the stall characteristics are otherwise similar to symmetric or clean loading.

11.6.1.5 Accelerated Stalls - Cruise Configuration. The amount of pre-stall buffet warning in maneuvers varies with airspeed and altitude. At higher altitudes the buffet starts as mild buffet and builds to heavy buffet at the stall. As altitude decreases and airspeed increases, the buffet band compresses, moves closer to the stall, and the magnitude of the initial buffet increases. Stall AOA decreases as Mach increases. The stall itself is primarily a pitch oscillation (bucking motion) accompanied by wing rock at all airspeeds and altitudes. This pitch bucking motion is noticeable at AOA anywhere between buffet onset, which is essentially where maximum lift occurs, and full aft stick. Easing aft stick is all that is required to recover.

11.6.1.6 Accelerated Stalls - PA/TO Configuration. It is difficult to obtain an accelerated stall in the takeoff or landing configuration (gear down/flaps HALF or FULL/SLATS OUT), especially with power on. Because full (or nearly full) aft stick is required to stall, stick forces are high (18 to 20 pounds). At approximately 24 units AOA buffet begins and the level increases significantly, giving a good indication of impending stall. At approximately 27 units AOA, a rapid, uncommanded increase in pitch rate occurs, immediately followed by the pitch rate decreasing. In most cases this occurs with full aft stick. If aft stick is held, aircraft AOA oscillates about 30 units and the aircraft becomes less stable laterally, giving the impression of wallowing. Ailerons are less effective, but are adequate for roll control during recovery. If the stall is held, the pilot can get out of phase with the roll and get into a mild wing rock. Recovery is immediate with relaxation of aft stick. Some small roll and yaw oscillations may be present during recovery. Rudder is effective in controlling the roll/yaw oscillations following the stall.

11.6.2 Lateral Stick Rolls. During lateral stick rolls above buffet onset, the aircraft rolls in the direction of the applied lateral stick. However, an abrupt pitchup due to inertial coupling, or mild roll oscillations may be experienced during the roll. During maneuvers near full aft stick, a large amount of sideslip is usually present as the lateral stick is neutralized following bank angle changes near 180 degrees. This sideslip generally results in an additional uncommanded roll in the direction of the original roll command or as much as 180 degrees due to strong lateral stability. However, depending on control input timing, the aircraft could experience no additional roll or a slight nosedown motion or unload. If controls are neutralized, all rates will return to zero following the uncommanded roll.